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Presurgical Psychosocial Predictors of Acute Postsurgical Pain and Quality of Life in Children Undergoing Major Surgery

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Abstract: **Limited research has examined presurgical risk factors for poor outcomes in children after major surgery. This longitudinal study examined presurgical psychosocial and behavioral factors as predictors of acute postsurgical pain intensity and health-related quality of life (HRQOL) in children 2 weeks after major surgery. Sixty children aged 10 to 18 years, 66.7% female, and their parent/guardian participated in the study. Children underwent baseline assessment of pain (daily electronic diary), HRQOL, sleep (actigraphy), and psychosocial factors (anxiety, pain catastrophizing). Caregivers reported on parental pain catastrophizing. Longitudinal follow-up assessment of pain and HRQOL was conducted at home 2 weeks after surgery. Regression analyses adjusting for baseline pain revealed that presurgery sleep duration ($\beta = -.26$, $P < .05$) and parental pain catastrophizing ($\beta = .28$, $P < .05$) were significantly associated with mean pain intensity reported by children 2 weeks after surgery, with shorter presurgery sleep duration and greater parental catastrophizing about child pain predicting greater pain intensity. Adjusting for baseline HRQOL, presurgery child state anxiety ($\beta = -.29$, $P < .05$) was significantly associated with HRQOL at 2 weeks, with greater anxiety predicting poorer HRQOL after surgery. In conclusion, child anxiety, parental pain catastrophizing, and sleep patterns are potentially modifiable factors that predict poor outcomes in children after major surgery.**

Perspective: ***This study addresses an important gap in literature, examining presurgical risk factors for poorer acute postsurgical outcomes in children undergoing major surgery. Knowledge of these factors will enable presurgical identification of children at risk for poorer outcomes and guide further research developing prevention and intervention strategies for these children.***

Key words: *Acute pain, health-related quality of life, children, spine fusion, surgery.*

Around 5 million children undergo surgery in the United States each year,[8,38] and it is estimated that between 40 and 60% experience moderate-severe pain while in the hospital.[13] Reported rates of acute postsurgical pain in children have remained similar over the past 2 decades[7,13,44] despite advances in perioperative care. Once present, moderate-severe postsurgical pain can be difficult to control[13] and can contribute to poorer clinical outcomes, including delayed recovery, and decreased satisfaction with care.[6,19,46] Moreover, recent studies suggest that postsurgical pain may persist beyond the healing period in many children after general or orthopedic surgical procedures such as spine fusion and pectus repair surgery.[3,11,21,35,47] A critical barrier to targeted prevention and treatment strategies in this context is that modifiable presurgical risk factors have not yet been identified.

The biopsychosocial model of pain demonstrates the interrelationship among biological, psychological, and social processes in determining response and adaptation to painful events and has been used to highlight factors applicable to perioperative management and postsurgical recovery.[26] Extensive research has established the importance of biopsychosocial factors in predicting pain after surgery in adults.[18] In the few studies conducted in children after surgery, several factors have emerged as potentially important risk factors for poor outcomes, including emotional factors (eg, child anxiety, child

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pain catastrophizing[10,34]), behavioral factors (eg, postsurgical sleep problems[16]), and social factors (eg, parental anxiety, parent pain catastrophizing[1,10]). However, several significant methodologic limitations in this prior research (including single retrospective ratings of pain, lack of measurement of functional outcomes, and lack of baseline assessment of risk factors) has precluded interpretation and application of findings. Weak measurement strategies such as use of single retrospective pain ratings introduce recall bias[36] and limit conclusions that can be drawn about postsurgical pain intensity. There has also been a lack of inclusion of functional outcomes in addition to pain intensity. Multidimensional assessment of function, for example, health-related quality of life (HRQOL), has been recommended for comprehensive understanding of acute pain outcomes in children.[28] Furthermore, assessments conducted prior to surgery are necessary to test risk factors that can eventually be targeted in children before surgery. Most prior studies have not performed assessments prior to surgery, and thus the literature is dominated by cross-sectional associations and limited understanding of variables that play a causal role in predicting poor postsurgical outcomes. Another limitation of prior research is that although studies have examined anxiety and pain catastrophizing in parents as potentially important factors in their child's pain experience,[32] there has been limited investigation of parental pain catastrophizing about *their child's* pain, which may be more relevant in this setting.

Therefore, this longitudinal study aims to address these methodological limitations by 1) examining the impact of major surgery on pain and HRQOL in children over time and 2) prospectively identifying modifiable psychosocial and behavioral factors at baseline that predict acute postsurgical pain intensity and HRQOL 2 weeks after major surgery in children. Based on prior literature, we hypothesized that 1) the majority of children would report moderate-severe pain and impairments in HRQOL at 2 weeks after surgery and that 2) presurgical assessments of higher child anxiety, higher child pain catastrophizing, shorter sleep duration, and higher parental catastrophizing about child pain would predict greater pain intensity and impairments in HRQOL 2 weeks after surgery.

Methods

Participants and Setting

Sixty children ages 10 to 18 years undergoing major surgery at a children's hospital in the northwestern United States and their parent or guardian (caregiver) were recruited into the study. The study was approved by the institutional review board. Caregivers provided informed consent, and children provided assent prior to research procedures.

Inclusion/Exclusion Criteria

Children were eligible if they were 1) ages 10 to 18 years, 2) undergoing either spinal fusion or pectus repair surgery, and 3) able to speak and read English. Children were excluded if 1) they had a serious comorbid health condition (eg, cancer, neuromuscular disease), 2) they had undergone prior major surgery, 3) they did not reside with their parent or guardian, or 4) their caregiver was not fluent in English. Eligible surgeries were chosen based on prior literature identifying these invasive procedures as at high risk for pain complications.[3,20,34,40,47] Indications for these surgeries include adolescent idiopathic scoliosis, juvenile scoliosis, spondylolisthesis, kyphosis, pectus excavatum, and pectus carinatum.

Recruitment

Eligible participants were identified from surgery clinic and procedure schedules and review of the electronic medical record over a 21-month period. Of 110 eligible families, 99 (90%) were approached in person or by telephone interview for potential participation in the study, and 11 (10%) were unable to be reached in time for baseline assessments. Of the 99 families approached, 60 (61%) agreed to participate and 39 (39%) refused because of lack of time or interest.

Procedures

Children underwent 2 assessments: a presurgery baseline assessment during the week immediately preceding surgery and a follow-up assessment that started 2 weeks after surgery. Each assessment was 7 days in duration and was completed at home.

Prior to surgery, children completed 7 days of daily monitoring of sleep with actigraphy and a daily electronic pain and sleep diary, with the final night being the night before surgery. At any time during this presurgery assessment, children and caregivers completed baseline self-report measures of sociodemographics, psychosocial factors (anxiety, pain catastrophizing), pain characteristics, and HRQOL. Baseline questionnaires, Actiwatches (Actiwatch 2; Phillips Respironics, MiniMitter Company Inc, Bend, OR), and personal digital assistants, used for the daily electronic diary, were couriered to the participants 1 week before surgery and were subsequently collected in-person on the participants' day of surgery.

The window of timing of participants starting the follow-up (2 weeks) assessment ranged from 8 to 21 days after surgery, with a mean of 14 days. During the postsurgical assessment, children repeated measures with the 7-day daily electronic pain and sleep diary, and questionnaires (pain characteristics and HRQOL) at home. Follow-up questionnaires and personal digital assistants were couriered to the participants 2 weeks after surgery and subsequently returned by participants via courier service. Clinical data were collected from the electronic medical record.

During the follow-up phase, 1 participant dropped out of the study because of lack of time, and 1 participant was lost to follow-up after surgery. Participants received gift cards to local stores on completion of assessments. Participants in this study are currently undergoing longer-term follow-up for which data collection is